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ABSTRACT

In this research, 103 Hispanic junior high school students were instructed using the Kumon Mathematical Method. Instruction took place 1 hour per day, 5 days a week in a public school setting. Instruction extended over an eight month period. Student subjects were pretested and posttested on the Mathematics batteries of the California Achievement Test (CAT). The amount of progress in mathematics was determined by computing gain scores for each section of the examination. Data included in this report includes: (1) CAT math concepts scores; (2) CAT computation and applications scores; (3) CAT total math scores; (4) school attendance; (5) Kumon Examination scores; (6) Kumon time scores; (7) number of packets completed; (8) Kumon level advancement; (9) class period; (10) academic track; and (11) grade level. Correlational relationships between variables are also discussed. Reported were significant gains in math computation, math concepts, and math applications scores at the seventh grade level; grade 8 students maintained their percentile rankings for the duration of the study; subjects significantly increased their speed on the Kumon exam; and CAT math gain scores were greater for the seventh graders than for the eighth graders. CAT gain scores were correlated with post Kumon exam scores. CAT gain scores were not correlated with Kumon exam time scores, number of Kumon packets completed, or Kumon advancement. (Author/CW)

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A STUDY OF THE EFFECTS OF THE KUMON METHOD UPON THE MATHEMATICAL DEVELOPMENT OF A GROUP OF INNER-CITY JUNIOR HIGH SCHOOL STUDENTS

Suzanne L. Medina

December 10, 1989

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ABSTRACT

One-hundred three Hispanic junior high school students were instructed using the Kumon Mathematical Method. Instruction took place one hour per day, five days a week in a public school setting. Instruction extended over an eight month period beginning October 1988 and ending in early June of 1989.

Student subjects were pretested and post tested on the Math batteries of the C.A.T. (California Achievement Test). The amount of mathematical progress made over the eight months was determined by computing gain scores for each of the sections of the CAT examination. These data are presented in the report as are the data on a number of other variables: 1) CAT Math Concepts pre and post scores, 2) CAT Math Computation and Application pre and post scores, 3) Total Math pre and post scores, 4) Attendance, 5) Kumon Exam pre and post scores, 6) Kumon Time pre and post scores, 7) Number of Packets Completed, 8) Kumon Level Advancement, 9) Period, 10) Track, and 11) Grade. Also included in the report is a description of the correlational relationships between CAT Gain scores and the other variables.

Seventh grade pre and post CAT Math Computation scores were statistically significant (.001). Seventh grade Math Concepts and Application scores were also significant (.01). Eighth graders maintained their percentile ranks over the course of the eight months. Subjects significantly increased their speed on the Kumon Exam. CAT Math Gain scores were greater for seventh graders than they were for eighth graders.

CAT Gain scores were correlated with post Kumon Exam scores, yet CAT Gain scores were not correlated with Kumon Exam Time scores, number of Kumon packets completed or amount of Kumon advancement.

ORGANIZATION OF THIS REPORT

This report was organized into nine major sections:

I	INTRODUCTION
II	SUBJECTS
III	DESIGN
IV	PROCEDURES
V	RESULTS
VI	SUMMARY OF FINDINGS
VII	OBSERVATIONS
VIII	APPENDICES
IX	REFERENCES

I INTRODUCTION

The focus of the study is established in this section. Following this is a brief discussion of the series of events which preceded this study.

II SUBJECTS

This section describes the student subjects including their school environment, tracking system and school calendar. It delineates the manner in which students were selected for this study, then presents a breakdown of student participants by grade, track and period. Finally, based on CAT pretest scores, it describes the students' linguistic abilities as compared to the national norm population.

III DESIGN

The overall structure of the study is discussed in this section, as are each of the variables which make up this study.

IV PROCEDURE

In this section of the report, the instructional and testing procedures used during the course of this study are described.

V RESULTS

The RESULTS are divided into two parts. The first part describes and presents data on the mean scores belonging to each variable, while the second section deals specifically with correlational relationships between CAT Gain scores and the other variables in the study.

VI SUMMARY OF FINDINGS

Here, the reader is provided with a summary of the data reported previously in the RESULTS section of this report. This more comprehensible rendition of the data may be directly consulted without previously reading the RESULTS section in order to learn of the most significant findings in the study. If greater detail is desired, the reader may wish to consult the tables in the RESULTS section.

VII OBSERVATIONS

This section contains a number of remarks and observations which may or may not have been supported by the data.

VIII APPENDICES

Included in this section is the correlation matrix of all variables as well as three frequency distributions : 1) CAT Math Computation Gain Scores, 2) CAT Total Math Gain Scores, and 3) CAT Math Concepts and Application Gain Scores.

IX REFERENCES

This section provides bibliographic information of the texts mentioned in this report.

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A STUDY OF THE EFFECTS OF THE KUMON METHOD UPON THE MATHEMATICAL DEVELOPMENT OF A GROUP OF INNER-CITY JUNIOR HIGH SCHOOL STUDENTS

I INTRODUCTION

The present study was designed to investigate the relationship between Kumon mathematics instruction and mathematical progress as measured by the CAT (California Achievement Test). Pre and post test score means were compared for all three sections of the CAT exam and the Kumon Exam. Attendance means were also computed over the three quarters as were the number of packets completed. Average Kumon level advancement for the eight month period was also determined. Furthermore, this study investigated the correlational relationships between the amount of mathematical improvement as measured by CAT gain scores and a number of variables: 1) CAT Math Scores, 2) Attendance, 3) Kumon Exam (Exam Scores and Time scores), 4) Kumon Packets Completed, 5) Kumon Level Advancement, 6) Other variables (Grade, Track, and Period).

This current study evolved as a result of a pilot study which was conducted in 1988 at Macey Intermediate School in Montebello. In this previous study, a total of 63 junior high school seventh and eighth grade students comprised Kumon and Traditional mathematical instructional groups. Several factors made it difficult to formulate any conclusions regarding the effectiveness of one method over the other. First, due to a high attrition rate, the number of subjects participating in the study were insufficient. Furthermore, the number of students comprising the Kumon groups was so small (i.e. ten) that it made it difficult to perform a matched pairs statistical analysis. An additional difficulty presented by this study study was the relatively short duration of time over which the study extended. Consequently, it was determined that a more substantive analysis was in order, one which involved a larger number and better balance of subjects over a longer period of time. The principal of Macey Intermediate School then transferred to Bell Gardens Intermediate school where, after a series of negotiations, the Kumon mathematical program was installed beginning September of 1988. During the Spring of 1988 a number of meetings were held to discuss the findings of the pilot and it was decided that a larger study was possible.

II SUBJECTS

School Setting

Subjects participating in this study were enrolled at Bell Gardens Intermediate School. This secondary institution, a member of the Montebello School District, is located in Bell Gardens, California, which is southwest of Los Angeles. Bell Gardens serves a student population of 2001 sixth, seventh and eighth graders, the vast majority of whom are Hispanic and low-income.

Tracking and the School Calendar

Consistent with the policies of the district, Bell Gardens Intermediate School functions on a year-round calendar basis. Thus, students are assigned to one of four groups of "tracks" : A,B,C, or D. Each track completes four quarters over the course of the school year though at differing times during the school year. Typically, an instructional period of anywhere from 38 to 49 days is followed by a vacation period of 21 days. The exact number of instructional days varies with each track and does not include assemblies or student holidays. This pattern repeats itself over the course of the academic year thereby creating year-round schooling. Given this configuration, there are no more than three tracks on the school premises at any given period of time.

Selection of Students

Selection for participation in this study was made on a referral basis. That is, letters describing the Kumon Math program were distributed to all mathematics teachers, counselors, and vice principals. In these letters, school personnel were urged to recommend students who met at least one of the following criteria:

(1) Students were performing unsuccessfully in their traditional mathematics class,

(2) A teachers felt that more individualized attention might benefit the student,

(3) There were gaps in the student's knowledge of mathematics.

It should be noted that in most instances, the referred students were low-achievers, though this was not always the case. High achievers were referred into the Kumon class because the traditional mathematics course was not sufficiently challenging. Also, referred students often demonstrated behavior and attendance problems in their former math classes. Using these referral procedures, often no more than four students from each traditional mathematics class were referred into the Kumon class. A total of 198 students enrolled in the Kumon Math class. However, for a number of reasons students were dropped

from the study. Thirty-five left the program because they were transferred to other schools. Another 50 were dropped because there were no CAT pretests on record with which their post tests could be compared. Most of these were limited English speakers who had taken a Spanish alternative to the CAT examination in October. Still other students were dropped from this study when they were radically unlike the other subjects in the study. One student, for example, was dropped because he was mentally retarded unlike the other subjects in this study who were normal. Three others were dropped because their studies were not continuous and consistent like the other subjects, but instead had been interrupted for long periods of time. The remaining student participants consisted of 103 normal seventh and eighth grade students, 76 of which were seventh grade students and and 27 of whom were eighth grade students.

Distribution of Subjects

This program was made available to students belonging to all periods, grades (seventh and eighth) and tracks. Thus, subjects participating in this study were distributed across two grade levels (i.e. seventh and eighth grades), six periods, and four tracks. As Table 1 indicates, the seventh grade group was larger (N=76) than the eighth grade group (N=27). Also, there was a somewhat greater representation from Track B in both grade levels than there was Track A. Similarly, period one was more heavily represented than the other periods.

Table 1
Distribution of Subjects by Grade Level and Period

	Grade 7					Grade 8				
	Track					Track				
Period	A	B	C	D	Total	A	B	C	D	Total
1	5	8	7	7	27	0	0	2	0	2
2	0	2	3	0	5	0	5	0	4	9
3	4	6	2	3	15	0	1	1	1	3
4	0	3	2	0	5	0	2	0	0	2
5	8	0	3	2	13	2	0	2	1	5
6	0	6	0	5	11	0	5	1	0	6
Total	17	25	17	17	76	2	13	6	6	27

Linguistic Characteristics of Subjects

Table 2 presents mean scores of the language sections of the CAT examination. Seventh grade students obtained a mean of 666 on the CAT vocabulary section, and 643 and 678.61 on the Reading Comprehension and Total Reading sections of the examination. Eighth graders scored 687.00, 712.74, and 700.33 on the Vocabulary, Reading Comprehension and Total Reading portions respectively. Student means on the various CAT batteries ranged from the first percentile to the eighth percentile. The seventh graders participating in this study scored no higher than the first percentile of the norm population on Reading Comprehension. Stated differently, 99 percent of the population performed better than the seventh grade group. Eighth graders ranked slightly better at the fourth percentile, indicating they scored higher than 4 percent of the population. In terms of vocabulary, both grade levels ranked at the eighth percentile. CAT Total Reading Score means belonging to the seventh and eighth graders placed them in the seventh and sixth percentiles respectively.

Table 2

Seventh and Eighth Grade CAT Vocabulary, Reading Comprehension and Total Reading Scale Scores Means, Percentiles and Grade Equivalents

	Vocabulary	Comprehension	Total Reading
Grade 7			
Scale Score	666.20	643.32	678.61
Percentile	8	1	7
G E	3.6	2.9	4.1
Grade 8			
Scale Score	733.07	738.70	700.33
Percentile	8	4	6
G E	4.4	5.2	4.9

III DESIGN

The mathematical abilities of these students were, in most instances, particularly low, therefore, they constituted a subset of the total school population. Given the special characteristics of this group, it would not have been appropriate to compare this group with another. Instead, the effects of the Kumon instruction on all students in this group was measured by computing their CAT Gain scores on the three mathematical sections of the exam.

Data were obtained on the variables related to the objectives of this study. This involved the maintenance of records for each student including his track identification, grade, period, quarterly attendance in the program, number of Kumon packets completed per quarter, number of Kumon levels progressed, pre and post scores on three math sections of the CAT examination, and pre and post Kumon exam scores.

Variable Definition and Measurement

CAT Math Scores

The major measure of math proficiency consisted of a standardized examination, the CAT (California Achievement Test). Two mathematical batteries from the CAT exam were used for the purposes of this study: Mathematical Computation and Mathematical Concepts and Application, which consists primarily of word problems and applications. Two verbal batteries of the CAT examination were used as well for the pre testing only: the Vocabulary and Reading Comprehension sections. Furthermore, mathematics battery scores were averaged, generating a Total Math score. Similarly, Total Reading scores were representative of both verbal scores. Scale scores were used since these provided interval level data.

Attendance

Records regarding the number of days which students participated in the program were also maintained for each quarter. Because attendance was determined on the basis of first period attendance records, the numbers provided here must be considered as approximations. To make these calculations, the number of absent days from first period roll call were subtracted from the number of days possible given the quarter, the student's track, and date of entry into the Kumon program. Therefore, the total number of days in the program during any given quarter varied depending upon a number of factors: the number of quarter absences, track membership, and date of entry into the Kumon program since students were allowed to enter the program at any point in the semester. It should be noted that each track differed slightly in the number of days during which instruction was conducted. During the second quarter, for example, Track A consisted of 42 days, Track B, 43 days, Track C, 45 days and Track D, 42 days.

Kumon Exams

The Kumon diagnostic exam (P-2), tested elementary mathematical notions of addition and subtraction. Furthermore, the Kumon test was timed: The amount of time which it took the student to complete the exam was recorded in minutes. Consequently, a score of the number of problems correct was recorded as well as the time in minutes. This exam was administered before and after Kumon instruction.

Kumon Packets Completed

The number of Kumon packets completed by each student was recorded as well. This consisted of the number of packets which had been turned in each quarter. Since students were allowed to work on packets at home, this count included packets completed during the school periods as well as those completed at home. The total number of Kumon packets completed were recorded as well as the number completed per quarter.

Kumon Level Advancement

In order to determine the number of Kumon levels which students had completed for the duration of this study, records were kept of students' Kumon entry and exit levels. Entry and exit levels were then compared to determine the total amount of Kumon progress made over the course of the eight month period. By assigning a value for each Kumon level (e.g., 3A=100, 2A=200,etc.) and a value of .05 for each booklet completed, it was possible to generate interval level data, and consequently compare and compute differences between entry and exit levels. Thus, if a student had entered at level 2A and exited at level C-20, he had completed 4.1 levels. In this way it was possible to determine the total number of levels which had been completed for each student subject.

Other Variables

Other variables included in this study consisted of the following:

1) Grade level (7th and 8th)
2) Track (A, B, C and D)
3) Period (1, 2, 3, 4, 5, 6)

IV PROCEDURES

The following section describes the instructional method and testing procedure used with the 103 subjects.

The Kumon Method of Mathematical Instruction

Students participating in the Kumon classes received instruction five days per week for 50 minutes each day. Kumon instruction was delivered by a male American public school teacher who had received in-service training in the Kumon method. Format and methods used did not differ from one period to the other. Instructional consistency was maintained across tracks.

Given the nature of the student clientele and the public school setting, certain adjustments were required. Diagnostic testing, competency testing, and student record keeping were maintained in compliance with the Kumon Method. However, if a student could pass the level exam, he was allowed to advance to the next level, even if he had not completed all of the level packets. In most instances, students completed all level packets before testing out to the next level.

Instruction began on October 6, 1988 and ended on May 30 for those in Tracks A, B, and D and June 12 for those in Track C.

Testing Schedule

All students enrolled at the school, including the participants in this study, were tested in the middle of October of 1988 on the verbal and mathematical batteries of the CAT. After the administration of these tests and prior to receiving test results, Kumon participants were identified using the selection procedure already described. Form E of levels 16 and 17 respectively were administered to seventh and eighth graders during the pre and post testing sessions. The post tests of the CAT took place over a three day period during the last two weeks of the fourth quarter. During the first testing day, students received a practice test while the other two mathematics batteries were given on the following two days.

Upon entry into the Kumon program, the P-2 Kumon diagnostic test was administered. Students were placed in the appropriate Kumon level on the basis of these test results. At the conclusion of their Kumon studies, that is, during the last two weeks of the fourth quarter, students were again tested using the P-2 examination. Those students who were absent during the initial administration of the CAT or Kumon Post tests, were allowed to make up these tests upon their return to school during the two week testing period.

V RESULTS

In this section of the report, the data will be presented for each of the variables. The first section reports group means for each of the variables and other corresponding measures (i.e., percentile, grade equivalent). The second concentrates upon correlational relationships among the variables, most importantly, the correlations between CAT Gain scores and other variables.

SECTION A - GROUP MEANS

In the following section, sample means will be reported for each of the previously mentioned variables. A few comments are in order prior to their interpretation. First, in this section, the data will be broken down by grade level. Secondly, levels of significance are specified using asterisks. One to three asterisks symbolize the .05, .01, and .001. levels of significance respectively. These simply refer to the extent or degree to which a statistic can be attributed to chance.

(When a statistic is significant at the .01 level in a pre and post test situation, it means that it is highly unlikely that the observed differences between scores can be attributed to chance. Conversely, it is highly likely that the differences can be attributed to the treatment being used. In this case the instructional method is the treatment.)

Although there were a number of measures which were available for interpreting CAT scores, it was decided to report scale scores, percentile and grade equivalents since these were more appropriate given our objectives. Scale scores were recorded because they provided interval level data. Percentile ranks showed the relative placement of this sample group with respect to the national norm group.

Grade equivalent scores were also included in this study. Grade equivalent score refers to the grade equivalent which corresponds to a given scale score. For example, a group scale score of 706 is the mean belonging to a norm group which had completed mathematical instruction up to the seventh month of the fourth grade, or 4.7 grade equivalent.

Although grade equivalents have been provided here, caution must be taken in their interpretation. They represent the mean of the norm population which is a composite of scores belonging to students from a variety of ethnic backgrounds. According to the CAT norms manual, there may be a difference of approximately 20 scale scores across ethnic groups. Therefore, the grade equivalents in the following tables represent this central point in that spread.

1. CAT Math Exam Scores

A. CAT Mathematical Computation

On the Math Computation battery of the CAT examination, seventh graders pretested at 706.64 which corresponded to 4.7 grade equivalent units. These same students post tested at 724.64 which represented 4.8 grade equivalent units. The difference between seventh grade pre and post test scale scores was statistically significant. Seventh grade percentile rank at the time of the pre test was 6 while it was 10 at the time of the post test. As Table 3 indicates, the eighth grade Math Computation pretest score mean was 733.07 while the post test mean was 738.70. The difference between pre and post test means was not statistically significant. Eighth grade grade equivalents were 5.6 and 5.3 for the pre and post tests respectively. Eighth grade pretest percentile rank was 9 while the post test percentile was 10.

Table 3

Seventh and Eighth Grade Pretest and Post Test CAT Math Computation Scale Score Means, Percentiles, and Grade Equivalents

	Pretest	Post Test	t value
Grade 7			***
Scale Score	706.64	724.64	5.48
Percentile	6	10	
GE	4.7	4.8	
Grade 8			
Scale Score	733.07	738.70	
Percentile	9	10	
GE	5.6	5.3	

*** $P < .001$

B. CAT Mathematical Concepts and Application

As Table 4 indicates, the difference between seventh grade pre and post test means (671.41 and 681.53 respectively) was significant (.01) on the Math Concepts and Application battery. Eighth grade pre and post test differences were not statistically significant. The seventh grade GE (grade equivalent score) of 3.9 remained constant at the time of the pre and post tests; grade equivalent scores belonging to the eighth grade group decreased slightly from 4.3 to 4.0. The seventh grade percentile rank increased from the eighth percentile at the time of the pretest to the ninth percentile during post testing. Eighth grade percentile status decreased from the sixth to the fifth percentile rank.

Table 4

Seventh and Eighth Grade Pretest and Post Test CAT Math Concepts and Applications Scale Score Means and Corresponding Grade Equivalents

	Pretest	Post Test	t value
Grade 7			**
Scale Score	671.41	681.53	2.99
Percentile	8	9	
GE	3.9	3.9	
Grade 8			
Scale Score	682.30	684.67	.58
Percentile	6	5	
GE	4.3	4.0	

** P = .0038

C. CAT Total Math

Seventh graders averaged 689.26 on the pretest of the CAT Total Math exam and 703.36 on the post test. This difference in means was statistically significant (.001) for seventh graders. Grade equivalent scores corresponding to seventh grade pre and post tests were 4.5 and 4.4 respectively. The difference between the eighth grade Total Math pretest mean (708.04) and the post test mean (711.96) was not statistically significant. The eighth grade percentile rank was 6 for both pre and post tests. The eighth grade pretest grade equivalent score was 5.1, while the post test grade equivalent was 4.8.

Table 5

Seventh and Eighth Grade Pretest and Post Test CAT Total Math Scale Score Means, Percentiles, and Grade Equivalents

	Pretest	Post Test	t value
Grade 7			***
Scale Score	689.26	703.36	6.03
Percentile	6	8	
GE	4.5	4.4	
Grade 8			
Scale Score	708.04	711.96	1.06
Percentile	6	6	
GE	5.1	4.8	

*** P < .001

D. CAT Gain Scores

Table 6 below summarizes the gain scores for each of the CAT exams already mentioned in this report. Seventh graders averaged a gain score of 18 points on the Math Computation portion of the CAT exam and 10.12 gain points on the Math Concepts and Application portion. This resulted in a Total Math Gain score mean of 14.09. For eighth graders, the Math Computation gain score mean was 5.63; the Math Concepts and Application mean was 2.37 yielding a Total Math mean of 3.93.

Table 6

Seventh and Eighth Grade CAT Gain Scale Score Means for Math Computation, Math Concepts and Application, and Total Math

	Math Computation	Math Concepts and Application	Total Math
Grade 7	18.00	10.12	14.09
Grade 8	5.63	2.37	3.93

2. Attendance

Table 7 presents the average number of days which seventh and eighth graders received Kumon instruction per quarter. Seventh graders attended an average of 27.04 days during the second quarter, 34.22 during the third quarter, and 45.13 during the fourth quarter. Eighth graders attended an average of 25.33 days during the second quarter, 32.85 days during the third quarter and 44.30 days during the fourth quarter. The mean number of days which seventh graders participated in Kumon instruction over the eight month period was 106.39; eighth graders participated a total mean of 102.48 days. In Table 7 the letters AQD denote the average number of days for a given quarter. ATD represents the average number of total days which the students could possibly attend for the three quarters.

Table 7

Seventh and Eighth Grade Total and Quarterly Attendance Means

	Quarter 2 (AQD:38)	Quarter 3 (AQD:43)	Quarter 4 (AQD:48)	Total (ATD:129)
Grade 7	27.04	34.22	45.13	106.39
Grade 8	25.33	32.85	44.30	102.48

The average number of Kumon instructional days was relatively low during the second and third quarters. This, however, was most likely due to the large numbers of students who entered the class late in the semester during these two quarters.

3. Kumon Exam

A. Kumon Exam Scores

The seventh grade Kumon pretest mean of 66.93 was significantly different (.01) from the post test mean of 68.32. The eighth grade pretest mean (67.11) and post test mean (69.15) were statistically significant at the .001 level. Table 8 displays these means as well as their corresponding standard deviations and t values.

Table 8

Seventh and Eighth Grade Kumon Pretest and Post Test Score Means, Standard Deviations and t Values

	Pretest	Post Test	t value	
Grade 7				1 ***
Means	66.93	68.32	3.68	
SD	3.39	2.28		
Grade 8				2 ***
Means	67.11	69.15	4.55	
SD	2.57	.92		

1
P = .0004
2
P < .001

While the difference of 2 to 3 points was statistically significant, the actual magnitude was small and does not represent a substantive content gain. It should be noted that with means in the high 60's, and a total possible of 70, the distribution was highly skewed with many students achieving the maximum score.

B. Kumon Exam Time Scores

As displayed in Table 9, 7.54 minutes represent the seventh grade pretest mean; 4.91 minutes represent the post test mean. This difference in pretest and post test scores was statistically significant (.001). Eighth graders pretested with a mean of 6.78 minutes and post tested with a mean of 4.23 minutes. The difference between pre and post tests was statistically significant (.001) as well.

Table 9

Seventh and Eighth Grade Kumon Pretest and Post Test Time Score Means (in minutes) and Corresponding t Values

	Pretest	Post Test	t value
Grade 7	7.54	4.91	8.25***
Grade 8	6.78	4.23	6.12***

*** $P < .001$

4. Kumon Packets Completed

The average number of Kumon packets completed per quarter have been displayed in Table 10 below. The mean number of Kumon packets completed by seventh graders during the second, third, and fourth quarters was as follows: 27.04, 34.22, and 45.13. For eighth graders these means per quarter were 36.33, 30.73, and 15.33.

Table 10

Seventh and Eighth Grade Mean Number of Packets Completed per Quarter

	Quarter 2	Quarter 3	Quarter 4
Grade 7	27.04	34.22	45.13
Grade 8	36.33	30.73	15.33

A number of factors may have influenced that number of packets completed. Lower level Kumon packets require less time to complete than do the higher level packets, therefore, one would expect higher level students to complete fewer packets. Also, the figures provided in Table 10 include the number of packets completed by students who entered at differing times during the quarter. Given this, it is not surprising that the mean number of packets were so low during the second quarter when a large number of students entered the program late in the quarter. During the fourth quarter, most students were present from the very beginning of the quarter.

5. Kumon Level Advancement

The average Kumon entry and exit levels belonging to seventh and eighth graders are displayed in the Table 11. As determined by the Kumon diagnostic examination, the average seventh grade Kumon entry level was 2A-31 while the average exit level was D-51. This difference represented a mean advancement of 4.10 Kumon levels (i.e., 4 levels and 2 packets). The eighth graders advanced four Kumon levels over the duration of this study since they began at a mean level of 2A-81 and exited at level D-81.

Table 11

Seventh and Eighth Grade Means of Kumon Entry Level, Exit Level and Total Levels Completed

	Entry Level	Exit Level	Total Levels
Grade 7	2A-31	D-51	4.10
Grade 8	2A-81	D-81	4.00

SECTION B - CORRELATIONS BETWEEN THE VARIABLES AND GAIN SCORES

The following section describes the significant correlations between each of the variables and the CAT Math gain scores: CAT Mathematical Computation Gain, CAT Mathematical Computation and Application Gain, and CAT Total Math Gain Scores. It should be noted that these correlations are based on a composite of data belonging to seventh and eighth grade subjects. Both of these groups were combined because there was no significant difference between their correlations.

It should further be noted that, given the number of subjects in this study, correlation coefficients which were statistically different from zero had to be greater than .254 to be significant at the .01 level. Those coefficients greater than .195 were significant at the .05 level.

Once a correlation is considered significant ($r \neq 0$), it must be then interpreted in terms of its strength. In Fundamental Statistics in Psychology and Education, Guilford (1956) distinguishes between the varying degrees of correlational strength (See Table 12).

Table 12

Guilford's Correlational Strengths

Correlation	Strength of the Correlation
0 - .2	Slight, almost negligible
.2 - .4	Low, definite but small
.4 - .7	Moderate, substantial
.7 - .9	High, marked
.9 - 1.00	Very high, dependable

For a complete listing of all correlational relationships please see Appendix D.

1. CAT Math Exam Scores

A. CAT Mathematical Computation

The CAT Mathematical Computation pretest scores were negatively correlated (-.355 **) with CAT Total Math Gain scores. Math Computation pretest scores were also correlated negatively at the same significance level with Math Computation gain scores (-.415 **). Math Computation post scores were positively correlated with the Math Computation Gain scores. Math Computation gain scores were positively correlated (.336 **) with post Math Computation scores.

B. CAT Math Concepts and Application

Math Concepts and Application pretest scores were significantly correlated at the .01 level (-.420 **) with Math Concepts and Application Gain scores.

Math Concepts and Applications post test scores were negatively correlated (-.238 *) at the .05 level of significance with Total Math Gain scores.

C. CAT Total Math

Total Math pretest scores were negatively correlated with all three CAT Gain scores: Math Computation Gain scores (-.225 *), Math Concepts and Application Gain scores (-.297 **), and Total Math Gain scores (-.355 **).

Total Math post test scores were positively correlated with the following gain scores: Math Computation Gain scores (.212 *) and Total Math Gain scores (.240 *).

D. CAT Gain Scores

Math Computation Gain scores were significantly correlated with Total Math Gain scores (.731 **). Math Concepts and Application Gain scores were also significantly correlated with Total Math Gain scores (.730 **). These are expected correlations since the Total Gain scores are an average of these two sections of the CAT exam.

2. Attendance

There were no significant correlations between any of the CAT Gain scores and quarterly attendance. Neither were there any significant correlations between Total Attendance scores and the CAT Gain scores.

3. Kumon Exam

A. Kumon Exam Scores

A significant negative correlation existed between the Kumon Exam pretest scores and Math Concepts and Applications Gain scores (-.241 *).

Kumon post exam scores were significantly correlated with two CAT gain scores: Math Concepts and Application Gain score (-.433 **) and Total Math Gain score (-.319 **).

B. Kumon Exam Time Scores

Neither the pre, nor the post Kumon Exam Time scores were significantly correlated with any of the three gain scores.

Kumon post Exam Time scores were significantly correlated with post Math Computation exam scores (-.417 **), post Math Concepts and Applications (-.417 **) and Total Math post test scores (-.459).

4. Kumon Packets Completed

No significant correlations existed between CAT gain scores and the number of packets completed per quarter.

5. Kumon Level Advancement

There were no significant correlations between the three CAT Math Gain scores and the number of Kumon levels advanced. Furthermore, there were no significant correlations between the Kumon Exit Level and the CAT Gain scores.

There was a positive correlation between Kumon exit level and CAT Math Computation post test scores (.5888 **) and Math Computation pretest scores (.494 **).

6. Grade

Grade level was negatively correlated with Math Computation Gain (-.197 *). There was also a negative correlation between Grade level and Total Math Gain (-.221 **).

7. Additional Correlations

There were other correlations found in the data which were not directly related to the issue at hand. Here, track and period correlations will be discussed briefly.

Track

There were no significant correlations between the track to which the student belonged and the CAT Gain scores.

Period

There were two negative correlations between the Period and CAT Gain scores. Period was significantly correlated with Math Computation Gain scores (-.238 **) and Total Math Gain scores (-.278 **).

In short, a number of other significant correlations were found in the data, however, it was not within the scope of this study to deal with all of these. For a complete listing of all correlational relationships please refer to Appendix D.

VI SUMMARY OF FINDINGS

The following section summarizes the findings for each of the variables discussed in this report. Each variable is discussed in terms of the seventh and eighth grade means as well as its correlation with gain scores.

1. CAT Math Scores

A. CAT Mathematical Computation

1) Means (Table 3)

* The 18 point difference between pre and post CAT Math Computation scores was statistically significant (.01) for seventh graders.

* The 5.63 difference between pre and post CAT Math Computation scores was not statistically significant for eighth graders.

* The seventh grade percentile rank increased from the 6th percentile on the pretest to the 10th percentile on the post test of the CAT Math Computation exam.

* Eighth grade percentile rank did not significantly change between pre and post tests of the Math Computation exam. Eighth grade students appear to have maintained their percentile rank in Math Computation.

2) Correlations with CAT Math Gain scores

* Low Math Computation pretest scores were related to high gain scores: 1) Total Math Gain scores (-.355 **), and 2) Math Computation Gain scores (-.415 **).

* High gains on the Math Computation portion of the exam were correlated with high post Math Computation scores (.336 **).

B. CAT Mathematical Concepts and Application

1) Means (Table 4)

* Seventh grade pre and post test means on the Math Concepts and Application portion of the CAT Exam were statistically significant (.01).

* Eighth grade pre and post test means on the Math Concepts and Application portion of the CAT Exam were not statistically significant.

* Both grade levels maintained their percentile ranks.

2) Correlations with CAT Math Gain Scores

* Low pretest CAT Math Concepts and Application scores were associated with high Math Concepts and Applications Gain scores (-.420 **).

* Low post test CAT Math Concepts and Application scores were associated with high Total Math Gain score (-.238 *).

C. CAT Total Math

1) Means (Table 5)

* CAT Total Math pre and post scores were significantly different for the seventh grade group. This was expected since Total Math scores are an average of the other two CAT Math exams which were also significant.

* The eighth grade CAT Total Math pre and post scores were not significantly different.

2) Correlations with CAT Math Gain Scores

* The lower the scores were on the CAT Total Math pretest, the higher were the following gain scores: 1) Math Computation Gain scores (-.225 *); 2) Math Concepts and Application Gain scores (-.297 **); and 3) the Total Math Gain scores (-.355 **). It was important to note that the relationship between the gain scores represented a regression effect. This implies the existence of some regression effect with lower scores making higher gains. While statistically significant at the .01 level, it represents only 12.6 % of the common variance (r squared equals .126).

* The higher the scores were on the CAT Total Math post test, the higher were the following gain scores: 1) Math Computation Gain scores (.212 *) and 2) Total Math Gain Scores (.240 *).

D. CAT Gain Scores

1) Means (Table 6)

* Total CAT Math Gain score means were higher for seventh graders than they were for eighth graders. This included Math Computation Gain scores, Math Concepts and Applications Gain scores, and Total Math Gain scores.

* The greatest gain scores reported for seventh graders was on the Math Computation battery of the CAT exam.

2) Correlations with CAT Math Gain Scores

* High Math Computation Gain scores as well as Math Concepts and Application Gain scores were correlated with high Total Math gains. Given that the Total Math gains are an average of the first two, this relationship was expected.

2. Attendance

1) Means (Table 7)

* For seventh graders, the mean number of Kumon instructional days increased over the course of the three quarters.

* For eighth graders, the mean number of Kumon instructional days increased over the course of the three quarters.

* The average total number of days the two grade levels attended Kumon classes differed by 4 days.

2) Correlations with CAT Math Gain Scores

* The attendance variable did not appear to be related to any of the CAT Gain scores.

3. Kumon Exam

A. Kumon Exam Scores

1) Means (Table 8)

* Differences between pre and post Kumon exam scores were statistically significant for the seventh grade group (.01).

* Differences between pre and post Kumon exam scores were statistically significant for the eighth grade group (.001).

2) Correlations with CAT Math Gain Scores

* Low Kumon pretest scores were associated with high Math Concepts and Applications Gain scores (-.214 *).

* Low Kumon post test scores (-.433 **) were associated with high gains in Math Concepts and Application.

* Low scores on the Kumon Post test were correlated with high Total Math Gains scores (-.319 **)

B. Kumon Exam Time Scores

1) Means (Table 9)

* The amount of time required to complete the Kumon examination significantly decreased for seventh graders (.001).

* The amount of time required to complete the Kumon examination significantly decreased for eighth graders (.001).

2) Correlations with CAT Math Gain Scores

* There was no relationship between Kumon Time scores and CAT Math Gain scores.

* Low Kumon Post test time scores were related to high scores on two CAT Math exams: 1) Post Math Computation exam (-.417 **), and the Post Math Concepts and Application Exam (-.417 **). Consequently, low Kumon post test time scores were correlated with Total Math post test scores (.459 **).

4. Kumon Packets Completed

1) Means (Table 10)

* The number of Kumon packets completed by seventh graders increased with each quarter.

* The number of Kumon packets completed by eighth graders increased with each quarter.

* Eighth grade packet completion dropped from an average of 30.73 packets during the Quarter 3 to 15.33 packets during Quarter 4.

* During the fourth quarter, the mean number of Kumon packets completed by eighth graders consisted of 15.33 packets.

* During the fourth quarter, the mean number of Kumon packets completed by seventh graders consisted of 45.13 packets.

2) Correlations with CAT Math Gain Scores

* The number of packets completed per quarter were not correlated in any way with CAT Math Gain scores.

5. Kumon Level Advancement

1) Means (Table 11)

* Eighth graders advanced an average of 4 Kumon levels.

* Seventh graders advanced an average of 4.10 Kumon levels.

* The average seventh grade Kumon entry level was 2A-31 while the exit level was D-51.

* The average eighth grade Kumon entry level was 2A-81 while the exit level was D-81.

2) Correlations with CAT Math Gain Scores

* There was no relationship between CAT Math Gain scores and Kumon levels completed.

* CAT Math Gain scores and Kumon exit level were not correlated.

* A high Kumon exit level was related to CAT Math Computation post test scores (.588 **).

* A high Kumon exit level was related to Math Computation pretest scores (.494 **). Based on these last two correlations, the Kumon levels appear to have a degree of construct validity with respect to the CAT (r squared equals .336).

6. Grade

Correlations with CAT Math Gain Scores

* The low grade level was related to high Math Computation Gain scores (-.197 *) and high Total Math Gain scores (-.221 *).

VII OBSERVATIONS

A number of relationships uncovered by the data have been presented and discussed in this report, yet there are a number of observations which will be made with respect to the program and these data.

Kumon Program Modifications

There were a number of modifications which were made to the Kumon instruction presented at Bell Gardens Intermediate school which distinguish it from the Kumon instruction which might take place in a private school setting.

1) Kumon in the Traditional Curriculum

At Bell Gardens, Kumon materials were used in place of the traditional ones. That is, Kumon instruction was not used to supplement a traditional curriculum.

2) Motivation Techniques

These public students were motivated by their instructor in a number of ways which may not be similar to those methods employed in the privately instructed Kumon classes. These included pep talks, certificates, the opportunity to purchase candy rewards, etc.

3) Public School Setting

In this study, Kumon Math was studied during the various periods of the day. Those participating during the later periods may have been subject to a number of factors which could have affected their performance. The correlations between period and CAT Gain scores support this: Students attending later in the day had lower CAT Math Computation Gain scores (-.238 *) and Total Math Gain scores (-.278 **) than those attending earlier.

4) Implementation of the Kumon Method

The way in which the Kumon program was executed also differed. The Bell Gardens Math instructor modified the method slightly by allowing students to have greater control over the time at which the mastery test was taken. That is, students were allowed to prove mastery of a given level when they felt they were ready. This introduced into the Kumon method an element of "learner control" (Hannafin and Peck, 1988), a highly desirable characteristic of instructional programs. Yet, it should be understood that students were not permitted to advance themselves to the next level, but simply have the freedom to take a level mastery test prior to completing all of the packets belonging to that level.

This element, however, does not characterize the Kumon method in its current form. The Kumon method is linear in its approach to instruction, therefore, once a student is placed into the appropriate level, there is no deviation from a prescribed sequence of levels and materials. The learn does not have the option of taking the mastery test prior to the completion of packets for that given level.

Interpretation of Results

While the results were not dramatic, the Kumon Method did appear to have positive effects upon a segment of the students participating in the study. It was apparent from studying the seventh grade CAT pre and post test scores that significant improvement had been made. (See Tables 3 thru 5) Students moved from the 6th percentile rank during their pretest to the 10th percentile during the post test in Math Computation.

Although eighth graders did not experience a similar increase, eighth graders maintained their percentile rank, indicating that they, at least, experienced an expected amount of progress in mathematical skill over the duration of this study. Since these students were mathematically several grade levels behind upon entry into this Kumon program, the maintenance of mathematical grade level should be viewed positively as the normal expectation is that students below grade level tend to fall further behind over time.

The results obtained characterize Kumon instruction in a public setting during an initial eight month stage only. The amount of improvement may have been greater than that reported here if the study had extended over a longer period of time.

VIII APPENDICES

APPENDIX A

FREQUENCY DISTRIBUTION
CAT MATH COMPUTATION GAIN SCORES

FREQUENCY DISTRIBUTION OF MCO/GN

CLASS INTERVAL	FREQ -#-	FREQ -%-
20 - 29	1	.97
30 - 39	3	2.91
40 - 49	6	5.83
50 - 59	9	8.74
60 - 69	11	10.68
70 - 79	19	18.45
80 - 89	11	10.68
90 - 99	12	11.65
100 - 109	12	11.65
110 - 119	8	7.77
120 - 129	7	6.8
130 - 139	2	1.94
140 - 149	0	0
150 - 159	0	0
160 - 169	1	.97
170 - 179	1	.97
> 180	0	0

Note: A gain score of 70 represents no gain. Gain scores below 70 signify negative gains, while those above 70 represent positive gains.

APPENDIX B

FREQUENCY DISTRIBUTION
CAT MATH CONCEPTS AND APPLICATION GAIN SCORES

FREQUENCY DISTRIBUTION OF MCN/GN

CLASS INTERVAL	FREQ -#-	FREQ -%-
10 - 19	2	1.94
20 - 29	1	.97
30 - 39	3	2.91
40 - 49	6	5.83
50 - 59	17	16.5
60 - 69	9	8.74
70 - 79	18	17.48
80 - 89	16	15.53
90 - 99	13	12.62
100 - 109	7	6.8
110 - 119	4	3.88
120 - 129	1	.97
130 - 139	2	1.94
140 - 149	3	2.91
150 - 159	0	0
160 - 169	1	.97
> 170	0	0

APPENDIX C

FREQUENCY DISTRIBUTION
CAT TOTAL MATH GAIN SCORE

FREQUENCY DISTRIBUTION OF TOM/GN

CLASS INTERVAL	FREQ -#-	FREQ -%-
25 - 29	1	.97
30 - 34	0	0
35 - 39	0	0
40 - 44	2	1.94
45 - 49	1	.97
50 - 54	3	2.91
55 - 59	5	4.85
60 - 64	13	12.62
65 - 69	8	7.77
70 - 74	6	5.83
75 - 79	8	7.77
80 - 84	11	10.68
85 - 89	9	8.74
90 - 94	10	9.71
95 - 99	5	4.85
100 - 104	6	5.83
105 - 109	8	7.77
110 - 114	1	.97
115 - 119	2	1.94
120 - 124	2	1.94
125 - 129	0	0
130 - 134	2	1.94
> 135	0	0

APPENDIX D
CORRELATION MATRIX OF ALL VARIABLES

—CORRELATION MATRIX—

	1 TRACK	2 GRADE	3 * VOC/PR	4 * COM/PR	5 MCO/PR	6 MCN/PR	7 * TOR/PR	8 TOM/PR	9 MCO/PO	10 MCN/PO
TRACK	1	.06188	.15706	.29801	.08217	.04992	.26463	.07355	.01791	.04292
GRADE	.06188	1	.2281	.27752	.31207	.12166	.29583	.24021	.17188	.03696
VOC/PR*	.15706	.2281	1	.6166	.38207	.52209	.91629	.50372	.31331	.43481
COM/PR*	.29801	.27752	.6166	1	.35617	.48515	.85905	.46985	.32273	.40736
MCO/PR	.08217	.31207	.38207	.35617	1	.61133	.41533	.89188	.71607	.56613
MCN/PR	.04992	.12166	.52209	.48515	.61133	1	.56704	.9031	.63307	.74341
TOR/PR*	.26463	.29583	.91629	.85905	.41533	.56704	1	.5475	.36577	.48092
TOM/PR	.07355	.24021	.50372	.46985	.89188	.9031	.5475	1	.7504	.73209
MCO/PO	.01791	.17188	.31331	.32273	.71607	.63307	.36577	.7504	1	.62582
MCN/PO	.04292	.03696	.43481	.40736	.56613	.74341	.48092	.73209	.62582	1
TOM/PO	.03365	.11436	.41514	.40672	.70931	.76384	.47082	.82146	.89742	.90568
#Q2*	- .46263	- .12545	.10333	- .12693	.07279	.09862	- .00301	.09813	.10551	.209
#Q3	.19229	- .12116	- .06077	.01496	.31271	- .04103	- .01288	.14575	.21595	.06797
#Q4	- .18192	- .07927	- .03012	- .19824	.16818	- .07545	- .09733	.04837	.23334	- .02729
TOT/#Q	- .01194	- .04645	- .02185	- .00723	.18469	- .0311	- .01916	.08225	.11263	.00182
ETLMPR	.0503	- .1119	- .16332	- .0674	- .37667	- .26993	- .12636	- .35961	- .36579	- .28994
ESCRPR	- .02381	.02453	.02487	.09296	.23023	.31324	.05088	.30329	.26667	.15185
ETDXPO*	- .03122	- .12598	- .12953	- .18371	- .38444	- .32459	- .17061	- .39594	- .41728	- .41785
ESCRPO*	.06236	.17822	.17125	.24191	.31895	.52445	.2368	.47391	.29966	.24149
#PAIQ2*	- .27378	- .07485	.05337	- .11634	.22771	.16574	.00018	.21903	.24056	.29433
#PAIQ3*	.03899	- .10133	.09212	.0067	.15939	.08719	.07313	.13628	.24304	.1387
#PAIQ4	- .14889	- .20868	.08275	.0748	.04303	.08992	.07249	.07507	.12267	.14398
#TOTPR	- .08814	- .12821	.16395	.07456	.27041	.18424	.13595	.25159	.28738	.26164
LVLIN	- .02265	.18383	.01295	.0303	.32176	.22117	.01872	.30141	.276	.17114
LVLOUT	- .06616	.07919	.13952	.08198	.49477	.35707	.12356	.47234	.58854	.35322
#LVLS	- .06606	- .04043	.13317	.05233	.27856	.20567	.1083	.26827	.40623	.24491
PERIOD	- .10444	.13314	- .14627	- .09695	- .09203	- .17187	- .15851	- .15014	- .27854	- .3103
MCO/GM	- .0875	- .19702	- .10632	- .06004	- .41599	.00013	- .08386	- .22544	.33688	.05166
MCN/GM	- .0131	- .1237	- .15586	- .14255	- .10547	- .42033	- .15557	- .29723	- .05556	.29442
TOM/GM	- .07003	- .22138	- .17812	- .13592	- .35539	- .28511	- .1618	- .35558	.19373	.23841

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11 TOH/PO	12 • #Q2	13 #Q3	14 #Q4	15 TOT/#Q	16 ETIMPR	17 ESCRPR	18 • ETIMPO	19 • ESCRPO	20 • #PAKQ2
.03365	- .46263	.19229	- .18192	- .01194	.050	- .02381	- .03122	.06236	- .27378
.11436	- .12545	- .12116	- .07927	- .04645	- .111	.02453	- .12598	.17822	- .07485
.41514	.10333	- .06077	- .03012	- .02185	- .163	.02487	- .12953	.17125	.05337
.40672	- .12693	.01496	- .19824	- .00723	- .067	.09296	- .18371	.24191	- .11634
.70931	.07279	.31271	.16818	.18469	- .376	.23023	- .38444	.31895	.22771
.76384	.09862	- .04103	- .07545	- .0311	- .269	.31324	- .32459	.52445	.16574
.47082	- .00301	- .01288	- .09733	- .01916	- .126	.05088	- .17061	.2368	.00018
.82146	.09813	.14575	.04837	.08225	- .359	.30329	- .39594	.47391	.21903
.89742	.10551	.21595	.23334	.11263	- .365	.26667	- .41728	.29966	.24056
.90568	.209	.06797	- .02729	.00182	- .289	.15185	- .41785	.24149	.29433
1	.17453	.15629	.1106	.06283	- .363	.2304	- .45977	.29646	.29637
.17453	1	.16143	.37808	.73397	- .185	.03807	- .02083	- .00963	.37187
.15629	.16143	1	.35119	.69974	- .072	.08406	- .16204	.01101	.0238
.1106	.37808	.35119	1	.38995	.024	.03159	.02041	- .07629	.0852
.06283	.73397	.69974	.38995	1	- .137	.14044	- .17972	.0213	.22608
- .36352	- .18598	- .07245	.02453	- .13745	1	- .14451	.56578	- .14588	- .05018
.2304	.03807	.08406	.03159	.14044	- .144	1	- .02539	.36762	- .10241
- .45977	- .02083	- .16204	.02041	- .17972	.5657	- .02539	1	- .24068	- .08531
.29646	- .00963	.01101	- .07629	.0213	- .145	.36762	- .24068	1	.07078
.29637	.37187	.0238	.0852	.22608	- .0501	- .10241	- .08531	.07078	1
.21028	- .29293	.01338	.13726	- .44514	.0467	- .06856	.03876	.01852	- .00455
.14721	.01361	- .11365	.11597	- .27356	.0831	.01819	.00559	.08013	.05214
.30426	.12526	.22114	.08125	.21985	- .0593	- .01693	- .11514	.08181	.72588
.24657	- .05249	.04625	.07058	- .08628	- .4927	.23429	- .38323	.2471	- .31947
.51872	- .0047	.22552	.13047	.16484	- .3218	.18987	- .43746	.3395	.32107
.35859	.03278	.18362	.07547	.21791	.0037	.02844	- .17781	.1649	.49675
- .32589	- .05189	- .02828	- .0867	.10639	- .0635	- .0519	- .01365	.0651	- .00723
.21237	.04727	- .14046	.07714	- .1024	.0315	.03686	- .02583	- .03968	.03138
.13726	.11968	.15084	.07078	.04691	- .0076	- .24157	- .10526	- .4331	.13053
.2409	.11091	.00811	.09894	- .03702	.0162	- .13856	- .08655	- .31957	.10811

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21 * #PAIQ3	22 #PAIQ4	23 #TOTPK	24 LVLIN	25 LVLOUT	26 #LVLS	27 PERIOD	28 MCO/GH	29 MCH/GH	30 TCH/GH
.03699	- .14889	- .08814	- .02265	- .06616	- .06606	- .10444	- .0875	- .0131	- .07003
- .10133	- .20868	- .12821	.18383	.07919	- .04043	.13314	- .19702	- .1237	- .22138
.09212	.08275	.16395	.01295	.13952	.13317	- .14627	- .10632	- .15586	- .17812
.0067	.0748	.07456	.0303	.08198	.05233	- .09695	- .06004	- .14255	- .13592
.15939	.04303	.27041	.32176	.49477	.27856	- .09203	- .41599	- .10547	- .35539
.08719	.08992	.18424	.22117	.35707	.20567	- .17187	.00013	- .42033	- .28511
.07313	.07249	.13595	.01872	.12356	.1083	- .15851	- .08386	- .15557	- .1618
.13628	.07507	.25159	.30141	.47234	.26827	- .15014	- .22544	- .29723	- .35558
.24304	.12267	.28738	.276	.58854	.40623	- .27854	.33688	- .05556	.19373
.1387	.14398	.26164	.17114	.35322	.24491	- .3103	.05166	.29442	.23841
.21028	.14721	.30426	.24657	.51872	.35859	- .32589	.21237	.13726	.2409
- .29293	.01361	.12526	- .05249	- .0047	.03278	- .05189	.04727	.11968	.11091
.01338	- .11365	.22114	.04625	.22552	.18362	- .02828	- .14046	.15084	.00811
.13726	.11597	.08125	.07058	.13047	.07547	- .0867	.07714	.07078	.09894
- .44514	- .27356	.21985	- .08628	.16484	.21791	.10639	- .1024	.04691	- .03702
.04676	.08319	- .05935	- .49272	- .32181	.00377	- .06351	.03153	- .00766	.01623
- .06856	.01819	- .01693	.23429	.18987	.02844	- .0519	.03686	- .24157	- .13856
.03876	.00559	- .11514	- .38323	- .43746	- .17781	- .01365	- .02583	- .10526	- .08655
.01852	.08013	.08181	.2471	.3395	.1649	.0651	- .03968	- .4331	- .31957
- .00455	.05214	.72588	- .31947	.32107	.49675	- .00723	.03138	.13053	.10811
1	.35419	.4005	.07299	.29893	.26191	- .25263	.10099	.06224	.11116
.35419	1	.39527	.01462	.3298	.32328	- .16759	.10177	.06686	.1135
.4005	.39527	1	- .21324	.49734	.65428	- .16261	9.6499998E-03	.0917	.07047
.07299	.01462	- .21324	1	.38308	- .29683	- .0846	- .07446	- .08385	- .10886
.29893	.3298	.49734	.38308	1	.7637	- .06512	.09936	- .03101	.04627
.26191	.32328	.65428	- .29683	.7637	1	- .02252	.15348	.03839	.13114
- .25263	- .16759	- .16261	- .0846	- .06512	- .02252	1	- .23874	- .1754	- .27859
.10099	.10177	9.6499998E-03	- .07446	.09936	.15348	- .23874	1	.06989	.73176
.06224	.06686	.0917	- .08385	- .03101	.03839	- .1754	.06989	1	.73082
.11116	.1135	.07047	- .10886	.04627	.13114	- .27859	.73176	.73082	1

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